

Portraying the Earth

Chapter 2

The Nature of Maps

- How and why do we describe the earth using maps?
 - When we need **to understand the world** around us we use maps.
 - A map is a **two or three-dimensional representation** of the Earth and a **spatial distribution of selected phenomena**—normally the components of a landscape.
 - The **basic attributes** of a map
 - Show **direction, distance, size, and shape**
 - **Spatial relationships of features** of the earth
 - Maps have a special purpose
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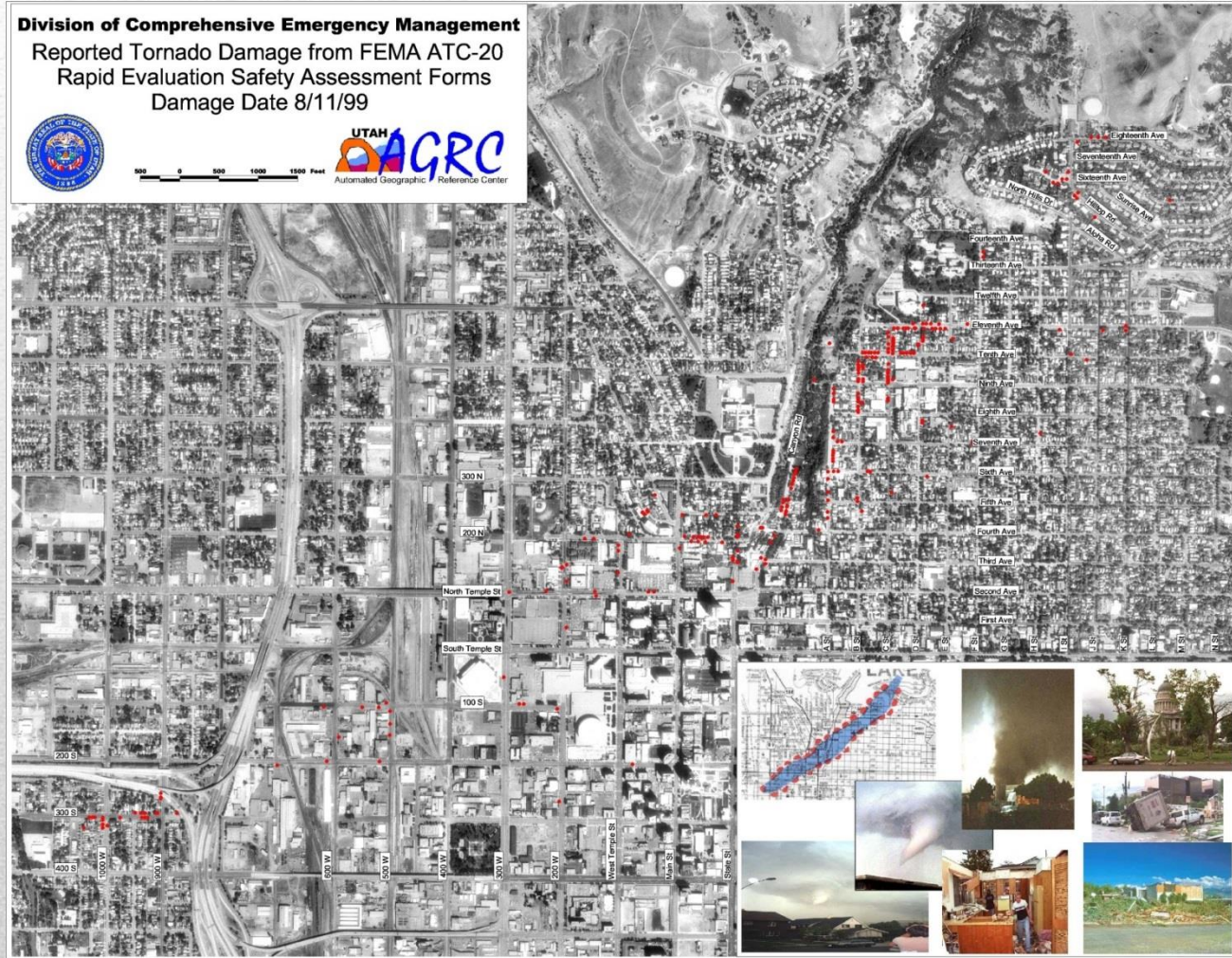
Map Scale

- The scale of a map gives the relationship between length measured on the map and corresponding actual distance on the ground.
 - Scale types
 - Graphic Map Scale uses a line marked off in graduated distances.
 - Fractional Map Scale compares map distance with ground distance in a proportional fraction or ratio called a **representative fraction**.
 - Verbal Map Scale or *word scale*, state in words the ratio of the map scale length to the actual distance on the Earth's surface.
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Large Scale and Small Scale

- **Large Scale Maps.**
 - Large representative fraction, or the denominator is small. 1:10,000
 - See more detail in the map
 - Portrays a smaller area of the earth
 - **Small Scale Maps**
 - Small representative fraction, or the denominator is large, 1:1,000,000
 - See less detail in the map
 - Portrays a large area of the earth
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Large Scale Map



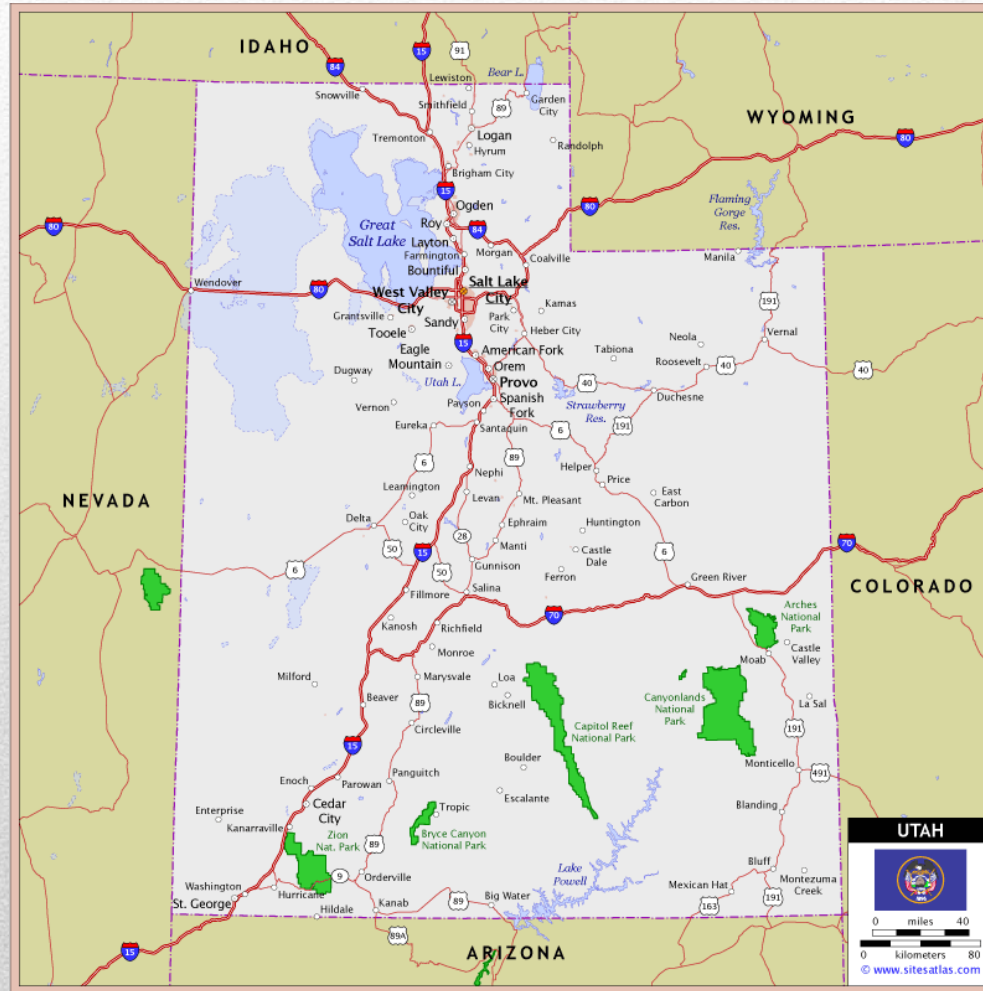
Small Scale Map



Map Essentials - Components of a Map

- **Title:** short brief summary of map's contents
 - **Date:** should be the date of the compilation of the data found on the map.
 - Can also be the date of the data found on the map
 - **Legend:** information about the symbols colors, and such used to depict the features of the map
 - **Scale:** if map is more than a pictogram. Scale can be either graphic, verbal, for fractional.
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Components of a Map



Map Essentials

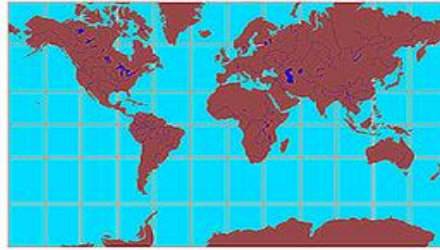
- **Direction:** a north arrow (top of the map, should be north). If there is a grid, there should still be a north arrow.
 - **Location:** grid, such as latitude and longitude, to be used to locate features
 - **Data Source:** source of the data found on the map
 - **Projection type:** in what projection is the data on the map
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Globes

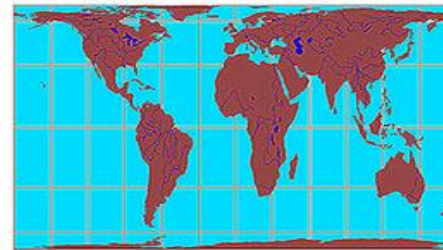
- **Best substitute** for depicting the earth
 - The only thing changed in depicting the earth onto a globe is the **size**
 - Shows comparative **distances, sizes, and accurate directions.**
 - **Represents without distortion**, the spatial relationships of features of the earth
 - **Problem, because the globe will be set a very small scale** (detail is lost)
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Map Projections

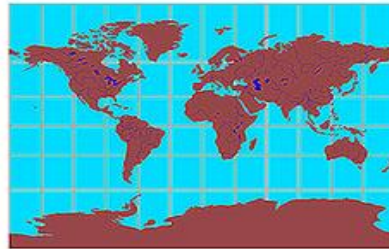
- A system whereby the **spherical surface of the earth is transformed to display on a flat surface.**
 - **Three basic projection styles for the earth**
 - **Cylinder**
 - **Cone**
 - **Flat**
 - Using a globe inside the Earth with each style, the lines or features are transferred to the paper
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Mercator Projection



Gall-Peters Projection



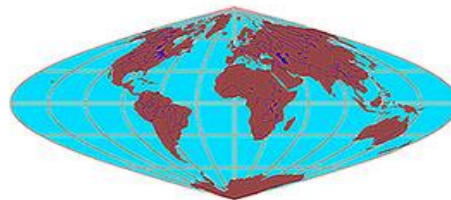
Miller Cylindrical Projection



Mollweide Projection



Goode's Homolosine Equal-area Projection



Sinusoidal Equal-Area Projection



Robinson Projection

Equivalence versus Conformaty

- **Equivalence Projection – equal area projection**
 - The size ratio of any area on the map to the corresponding area on the ground is the same all over the map
 - Desirable because misleading impressions are avoided.
 - Difficulty to achieve on small-scale maps, to maintain proper areal relationships
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Equivalence versus Conformaty

- **Conformal Projection – conformal relations**
 - Proper angular relationships are maintained so that the **shape of something on the map is the same as its shape on the Earth**
 - **Meridians and Parallels cross each other at right angles.**
 - Most notable projection is probably the ***Mercator projection.***
 - A ***Robinson projection*** is a compromise between a equivalence and conformality.
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Projections

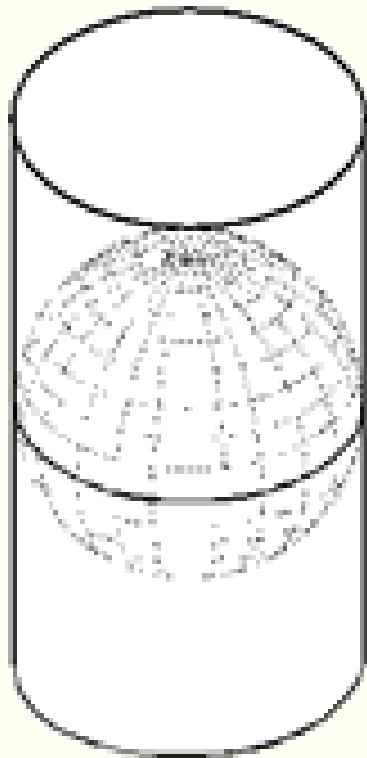
- **Mercator**, the most famous Projection
 - Developed in 1569 by Flemish geography and cartographer, **Gerhardus Mercator**.
 - Developed for **use in navigation of ships**
 - Advantage: shows *Loxodromes or Rhumb lines* as straight lines.
 - **Problem with the Mercator**,
 - **Extreme East-West distortion** in higher latitudes
 - To compensate **Mercator stretched the spacing** north and south to compensate.
 - Allowed shapes to **be reasonably accurate but proper size relationships distorted**.
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Projections

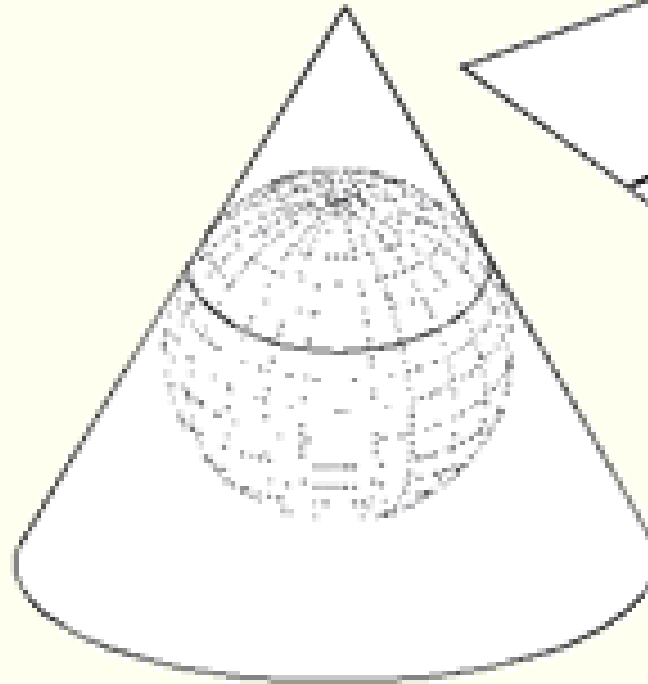
- The **Plane projection** – *azimuthal or zenithal projection*.
 - Obtained by **projecting markings of the globe on a flat piece of paper that is tangent** to one point of the globe
 - **Used often in large scale maps** or small areas of the globes
 - **Usually is shown from either the North Pole or the South Pole**
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Projections

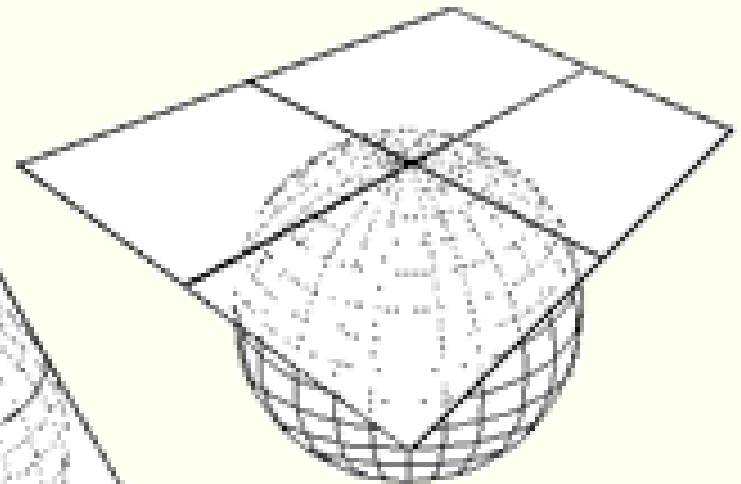
- **The Conic Projection**
 - Obtained by **projecting the markings of the globe onto a cone wrapped tangent to or intersecting a portion of the globe**
 - Normally the **apex of the cone is positioned about a pole** which means the circle of tangency coincides with a parallel.
 - Best suited for regions of **east-west orientation in the mid latitudes.**
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Cylindrical



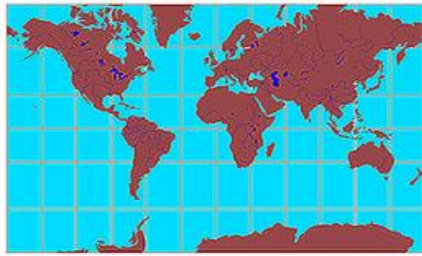
Conical



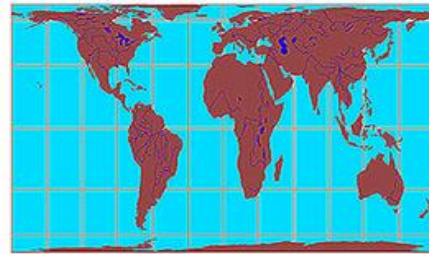
Azimuthal

Funky Projections

- **Pseudocylindrical projection** – elliptical or oval projection
 - Football shape of usually the whole world
 - **Interrupted projections**
 - Most famous – *Goode's interrupted homolosine projection*
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Mercator Projection



Gall-Peters Projection



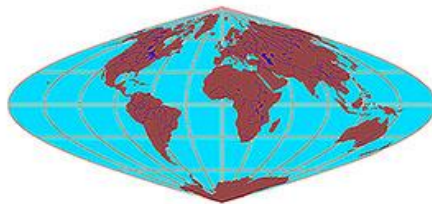
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Goode's Homolosine Equal-area Projection



Sinusoidal Equal-Area Projection



Robinson Projection

Computer Cartography

- Using **computers to create maps**
 - **Symap** (first software used to make maps)
 - **1965**
 - **Global Positioning Systems**
 - **Remote Sensing**
 - **Imagery**
 - **Multi-spectral Remote Sensing**
 - **Geographic Information Systems**
 - Widely used today
 - Expanding industry
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Isolines

- Portray the spatial distribution of some phenomenon on the earth.
 - **Isarithm, isogram, isopleth, and isometric lines** are synonymous for our purposes
 - Most important to physical geography
 - **Elevation Contour Line** – depicts elevation
 - **Isotherm** – depicts equal temperature
 - **Isobar** – depicts equal atmospheric pressure
 - **Isohyet** – depicts equal quantities of precipitation
 - **Isogonic Line** – depicts equal magnetic declination
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Characteristics of Isolines

- Always closed lines- is line comes to the end of a map the line probably proceeds to the next area
 - Represent gradations in quantity, never touch or cross one another
 - Numerical difference between one isoline and another is an interval.
 - Isolines close together indicate a steep gradient, those far apart indicate a gentle gradient.
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Global Positioning System (GPS)

- A satellite based system for determining accurate positions on or near the Earth's surface.
 - Developed in the 1970's for the military
 - Based on 24 high-altitude satellites configured so that a minimum of 4 satellites are in view of any position on the Earth.
 - Each satellite continuously transmits both identification and positioning information that can be picked up by receivers on Earth.
 - Position determined through triangulation.
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Remote Sensing

- Any measurement or acquisition of information by a recording device that is not in physical contact with the object under study-in this case the Earth.
 - **Satellite remote sensing**
 - Imagery obtained from geosynchronous orbit satellites.
 - **Aerial Photographs**
 - Photographs taken from an elevated platform, such as a balloon, airplane or rocket.
 - Photographs classified either oblique or vertical.
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Imagery

- **Orthophoto Maps** – multicolored, distortion-free photographic image maps.
 - All displacement caused by camera tilt or differences is removed.
 - Shows greater detail than a conventional map but retains the characteristic of a map
 - **Color or Near Infrared Imagery**
 - Refers to the visible-light region of the electromagnetic spectrum
 - Near Infrared Color is used to depict vegetation
 - **Thermal Infrared Sensing** – depicts temperature
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Multi-spectral Remote Sensing

- **Multi-spectral or Multi-band** – different regions of the electromagnetic spectrum
 - Landsat imagery
 - Launched in the 1970's and 1980's
 - Four spectral bands
 - **Earth Observing System (EOS)**
 - Moderate Resolution Imagery Spectroradiometer (MODIS)
 - 36 spectral bands
 - **Radar and Sonar Sensing**
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Geographic Information Systems (GIS)

- Automated system for the capture, storage, retrieval, analysis, and display of spatial data.
 - A GIS can manipulate rows and columns of tabular and links it to the spatial features it represents.
 - All the features depicted in the GIS have a coordinate system that ties them to a coordinate system of the earth
 - Knows where it is on the earth's surface
 - Allows for the many layers of different features to be overlaid to form maps that can be used to make decisions.
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